Mr. Frost explained that he had visited Mitcham in company with the hon. secretary on the previous day, and on inquiry they had found the complaint to be founded only on the non-appearance of a small crop of maize some three years ago. This was put down to the Magpies, but the evidence is discounted by the fact that the soil for miles round is too poor for crops of any description.

Mr. A. Coles stated that magpies occasionally eat grain, and that large numbers were being killed by the poisoned wheat laid for rabbits; the stomach of one containing several grains of wheat was exhibited by him at the July meeting of the Club.

The discussion was all in favour of the continued protection of the birds, as any slight damage is more than compensated for by the immense amount of good done in destroying insect pests.

EXHIBITION OF SPECIMENS.

The following were the principal exhibits of the evening :—By Mr. F. Barnard.—Microscopical Slides of Sponge Spicules and Foraminifera, from Newport coal shaft. By Mr. A. Coles.—Sheet of 101 eggs of the insectivorous Birds of Victoria, hand-painted in life colours, suitable for State schools. By Mr. C. French, jun.—Pair Mallee Hen eggs, also abnormal egg of same, collected in the Wimmera. By Mr. J. Gabriel.—Eggs of the Great Skua (*Stercorarius antarcticus*) from Kerguelen Islands; the birds are occasional visitors to Victorian waters. By Mr. T. A. Masters.—Specimens of Orchid *Pterostylis longifolia*. By Mr. G. J. Page.—Microscopic Slides of Foraminifera from Port Phillip Bay, transparent and opaque, and from coal shaft near Williamstown, opaque.

After the usual conversazione the meeting terminated.

THE VOLCANIC ROCKS OF THE MELBOURNE DISTRICT.

By T. S. Hart, M.A.

(Read before the Field Naturalists' Club of Victoria, 12th March, 1894.)

The prevailing rock formation of the country to the north and north-east of Melbourne for some distance is volcanic, forming extensive plains from the Plenty River and the upper parts of the Merri Creek and Deep Creek, in a south-westerly direction. They are bounded by and occupy hollows in the Palæozoic rocks, spurs of which reach down into the upper parts of the plains, but in the lower parts they are completely covered, except a few small areas where they reach a higher level or where the streams have cut through the basalt. The underlying rocks also include extensive deposits of Tertiary age in the lower parts, frequently

forming a regular line along both sides of the valleys under the basalt, and at some places Older Volcanic rocks.

These Older Volcanic rocks are divided into two groups in the geological survey maps—Older Volcanic and Lower New Volcanic. The largest area near Melbourne lies along and to the east of the Saltwater River, and reaches down to Melbourne, reappearing beyond the Yarra as Emerald Hill. The greater part of it is coloured and lettered on the maps as Older Volcanic, the south-east end is coloured and lettered as Lower New Volcanic, and the middle is coloured Lower New Volcanic and lettered Older Volcanic. It appears to be overlaid at South Melbourne by the same Tertiaries as on the Saltwater River, and though a small patch of clay coloured as Tertiary is shown underlying one part, it is a deposit containing fossil leaves quite different from that overlying the other part. As a rule the basalt is much decomposed, often weathering in concentric shells, as at North Melbourne. On the Moonee Ponds Creek, near Essendon, it may be seen in some quarries undecomposed—a dense black basalt. Other small areas of Older Volcanic rocks occur higher up the Saltwater. At the Green Gully, south of Keilor, the relations of the Silurian, Older Volcanic, Tertiary, and New Volcanic may be well seen. Another small patch occurs in the Spring Creek, east of Keilor, and a small patch in the Saltwater above that township. It also appears in a gully south-east of Sunbury Hill, where it is not shown on the maps, and the maps show three more small patches on the Emu Creek, east of Sunbury. In a quarry on the side of the Moonee Ponds Creek, above Broadmeadows, the columnar structure is distinctly seen; and also in the bed of the creek, just above this, there are very small columns, up to two inches diameter, of dense black basalt. Another patch occurs on the same creek at Pascoe Vale. A small area on the Deep Creek, above Bulla, is marked as Lower New Volcanic.

Several small outliers of basalt occur near Greensborough, on the Plenty River, where they are considered to be Lower New Volcanic as they seem to overlie the Tertiaries (though this is not certain), and have evidently been deeply eroded before the lava streams covered the plains, as these extend into some of the valleys between them. These are remnants, probably, of a once more widespread lava stream. The Sugarloaf Hill north of Heidelberg appears to have been once the bottom of a valley which has been filled by a lava stream. The basalt has since been removed, but the bed of the stream, with the drift in the hollows of the rock, all much hardened, remains as the top of the hill. Other small areas of volcanic rocks occur higher up the Yarra Valley, and at Lilydale there is a well-defined point of eruption. On the other side of the Dandenong Ranges Older Volcanic rocks occur at Harkaway and Berwick. At Wilson's

Quarry, Berwick, they overlie a deposit containing numerous fossil leaves, which seems to have been still in progress at the time of the lava flow. To the south they pass under Tertiary deposits, and may be continuous with the basalt found under 200 feet of Tertiaries at Mordialloc.

We thus see from the sections round Melbourne that there is a series of older volcanic rocks overlaid by marine Tertiaries, and perhaps a second series before the Newer Volcanic. The age of the first series of volcanic rocks has been put down as the close of the Miocene, the Tertiaries overlying them being regarded as Pliocene. But Messrs. Hall and Pritchard have recently shown ("Proc. Royal Soc. of Vic.," vol. ii., N.S.) that the Eocene strata at Bellarine rest on the denuded surface of similar volcanic rocks, and in other localities also the same relation exists. Further palæontological examination of the Tertiaries round Melbourne also tends to assign to them an earlier age.

Coming now to the Newer Volcanic rocks, we find that for the most part they form open plains with a shallow soil, and frequently very stony. The rock is for the most part basalt, varying in colour and texture at different places. It may be seen in section along most of the creeks and rivers in the plains, sometimes to a thickness of 100 feet; but over the old valleys it may often be much thicker. Points of eruption are very common, mostly in the upper parts, the nearest to Melbourne being one to the north-west of Somerton station, on the North-Eastern line. The lava streams have filled in the valleys, and have sometimes covered the hills dividing them. By this the drainage system of the country has been considerably modified. When a valley has been partly filled by a lava stream, it frequently happens that the river has cut out a new course along one side, the Silurian rocks being more easily denuded than the basalt; many instances of this occur. The Yarra occupies the boundary line between the basalt and Silurian from Alphington to Prince's Bridge, the basalt only once crossing to the left side of the river, at Hawthorn. The Saltwater above Sunbury, and the Deep Creek in the parish of Darraweit Guim, are other examples. The upper parts of each of the valleys as a rule contain several points of eruption—though it is not always clear how much of the basalt is due to each—and from these the basalt has flowed over the plains. In the upper parts of the Merri Creek there are seven points of eruption recorded in the quarter sheets. In one of these, Beveridge Hill, there is a distinct though much worn down crater, with a swamp in it. On one side there is a cutting in ash and scoriæ, near the Sydney road. Down the middle of the Merri Creek valley there is a line of inliers of Silurian rock which probably mark an old division of the valley into two. On both sides of the volcanic area there is a line of

Silurian hills, so that the Merri Creek receives the water from very little beyond the volcanic plain. Near Donnybrook the creek, which has been following the east edge of the plain, turns across it in a south-westerly direction, passing between two points of eruption; one of these (in Kalkallo, 21) marks the dividing line between the Plenty River and Merri Creek. It is not a large hill, but from the slope of the country it seems probable that its lava streams are very extensive. The Darebin Creek heads from it, and a note on the geological map gives it as the source of the lava streams to the south. From this point the lava streams extend to the east into the Plenty Valley; thence southward down a narrow valley in the Silurian rocks west of the present Plenty River, joining the main basaltic area south of Morang; and it appears not unlikely that the basaltic strip which goes from there down the Darebin Creek and the Yarra to Prince's Bridge may come from the same source. The width of the old valleys here seems quite out of proportion to the streams which flow down them: the Plenty River old valley is represented by a strip of basalt scarcely a mile wide, while on the other side of the Morang Hills the Darebin and Merri occupy a basaltic plain seven miles wide. The Plenty, and all its tributaries that meet the basalt, show extensive alluvial deposits above it, as if their flow had been checked; and it seems probable that all these tributaries formerly passed to the west of the Morang Hills, and perhaps the Plenty itself turned in the same direction.

To the west of the Merri Creek, and above the heads of the Moonee Ponds Creek, is another group of four volcanic hills. One of these, in sections 13 and 17 of the parish of Yuroke, has its surface strewn with numerous blocks of scoria and a little ash, with a few ejected blocks of granite and sandstone. Across the top of this hill there are two basalt dykes standing up above the hill. Two other points of eruption occur in section 20 of the same parish, from which creeks run west and north-west to the Deep Creek, south to the Moonee Ponds, and east to the Merri. The lava streams from this hill probably extend round the granitic area to the south, and down the south-west side of the Moonee Ponds Creek.

In the ranges at the head of the Deep Creek there is a point of eruption—the Jim-Jim, on the top of the Dividing Range—and two others a few miles lower down. In the neighbourhood of Lancefield there are several, and to the south-east, in the parish of Springfield, there are several more.

South of the Saltwater River, and north of the heads of the Toolern Toolern and Kororoit Creeks, and from there to Diggers' Rest, there is a line of volcanic hills, one of which, Mt. Aitken, reaches a height of 1,680 feet. These are all much denuded; on some of them indistinct outlines of a crater can be traced. One

of them, Sunbury Hill, has had extensive excavations made in it to level a site for the Lunatic Asylum. The excavations show a peculiar scoriaceous rock, probably indurated ash, and at several places portions of lava streams are exposed on the surface of the hill.

In the valleys of the Kororoit Creek and the Werribee, below Melton, the volcanic rocks are almost the only ones that appear : at one place, near Mount Mary, a creek shows over 100 feet in a section. But near the mouth of the Werribee the basalt is overlaid by a deposit marked as "Upper Brighton Beds." This, I think, refers to the deposit which forms the surface at Brighton—not the same "Upper Brighton Beds" as occur elsewhere between the Newer and Older Volcanic.

The Newer Volcanic rocks have been cut through by the rivers till in places they run in gorges over 100 feet deep, so that a considerable time must have elapsed since their outpouring. Though they are usually considered as marking the close of the Pliocene period, the referring of the underlying rocks to an older age makes it possible that they too are older, and a comparison of the surface of the Tertiary on which they rest with the hills and valleys into which the same have been worn where not protected, seems to indicate that the time between their formation and the lava flows was short compared with the time that has elapsed since. It would appear that the Tertiaries had suffered very little erosion before the lava streams covered them, and the outpouring of lava may have occurred simultaneously with the rising of the land.

SOME REFERENCES TO LITERATURE DEALING WITH GRAPTOLITES.

Instead of forwarding for publication a few unsatisfactory notes on the subject matter of my remarks on Graptolites before a recent meeting of the Club, I have thought that some hints on the literature of the group will be of use. As Graptolites occur in many of the countries of Europe and America, and as so many of the species have a world-wide range, the literature is much scattered, and many of the important papers are inaccessible in Melbourne.

As regards the structure of the group, Nicholson and Lydekker's "Palæontology" and Zittell's "Handbuch der Palæontologie" will be found useful. Both are in the Melbourne Public Library. A paper by Dr. Otto Herrmann, in the *Geological Magazine* for 1885, gives some information of great value. This publication is in the Club's library, the first volume of the set there being that for 1882. The earlier volumes of the *Geological Magazine* contain many valuable papers on the subject, but, strange to say, are not to be found in any of the Melbourne libraries. As so many of Lapworth's papers dealing with classification and